REMARKS

Claims 1-18 are pending in the current application. In an office action dated November 30, 2007 ("Office Action"), the Examiner rejected claims 1, 2, 4, 7, 8, and 10 under 35 U.S.C. §103(a) as being unpatentable over Wiessman et al., "ITW2002, Universal Discrete Denoising" ("Wiessman") in view of Luby, U.S. Patent No. 6,307,487 ("Luby") and rejected claims 13, 14, and 16 under 35 U.S.C. §103(a) as being unpatentable over Fitton et al., U.S. Patent Application Publication No. 2004/0085917 ("Fitton"). Applicants' representative respectfully traverses these 35 U.S.C. §103(a) rejections.

On page 4 of the Office Action, the Examiner states:

> However, Luby discloses a controller (fig. 4 (420)) that generates a processed digital signal from said received digital signal by replacing symbols in said received digital signal (col. 15 lines 42-46), wherein said controller replaces each symbol having a value **I** in a context of that symbol in said received digital signal with a symbol having a value **J** if said replacement reduces an estimate of overall signal degradation in said processed digital signal relative to said input digital signal as determined using said degradation function and said partially corrected sequence of symbols (col. 13 lines 49-60).
>
> Therefore, taking the combined teaching of Luby and Wiessman as a whole would have been rendered obvious to one skilled in the art to modify Wiessman to utilize a controller that generates a processed digital signal from said received digital signal by replacing symbols in said received digital signal for the benefit of error correction in a received signal.

The cited portion of Luby (Luby, column 15, lines 42-46) reads as follows:

> When reconstructor 420 finds an output symbol that is in the decodable set, the output symbol's value B(**I**) and optionally the value function F(**I**) is used to reconstruct the input symbol listed in AL(**I**) and the reconstructed input symbol is placed into reconstruction buffer 425 at the appropriate position for that input symbol.

Luby does not disclose replacing "each symbol having a value **I** in a context of that symbol and said received digital signal with a symbol having a value **J**." The above-quoted, cited passage of Luby discusses symbols with values B(**I**), not **I** and **J**. In Luby,

B(**I**) is the value of an output symbol associated with a key **I**. The notation "B(**I**)" is functional notation, and represents the fact that the symbol value B(**I**) is produced by a function that takes the key "**I**" as a parameter, as discussed in Luby beginning on line 48 of column 11. The notation "AL(**I**)" refers to a list of weighted positions of input symbols, as stated in the paragraph beginning on line 6 of column 15 of Luby. The recited passage of Luby does not discuss the context of a symbol, does not discuss signal degradation, an estimate of overall signal degradation, reduction of overall signal degradation, or anything even remotely related to an estimate of overall signal degradation. Luby is directed to encoding and decoding of data transmitted through communications channels. Luby is particularly concerned with communications channels in which data packets can be lost. Luby uses a particular type of erasure code, or error-correcting code, described beginning on line 24 of column 1. Luby states:

> Typically, the particular code used is chosen based on some information about the infidelities of the channel through which the data is being transmitted and the nature of the data being transmitted.

In the summary-of-the-invention section of Luby, beginning on line 63 of column 4, Luby describes the encoding and decoding system to which Luby's disclosure is directed:

> In one embodiment of a communications system according to the present invention, an encoder uses an input file of data and a key to produce an output symbol, wherein the input file is an ordered plurality of input symbols each selected from an input alphabet, the key is selected from a key alphabet, and the output symbol is selected from an output alphabet. An output symbol with key **I** is generated by determining a weight, W(**I**), for the output symbol to be generated, wherein the weights **W** are positive integers that vary between at least two values over the plurality of keys, selecting W(**I**) of the input symbols associated with the output symbol according to a function of **I**, and generating the output symbol's value B(**I**) from a predetermined value function F(**I**) of the selected W(**I**) input symbols. The encoder may be called one or more times, each time with another key, and each such time it produces an output symbol. *The output symbols are generally independent of each other, and an unbounded number (subject to the resolution of **I**) can be generated, if needed.* (emphasis added)

Luby then describes the decoder, beginning on line 14 of column 5, as follows:

> In a decoder according to the present invention, output symbols

> received by a recipient are output symbols transmitted from a sender, which generated those output symbols based on an encoding of an input file. Because output symbols can be lost in transit, the decoder operates properly even when it only receives an arbitrary portion of the transmitted output symbols. The number of output symbols needed to decode the input file is equal to, or slightly greater than, the number of input symbols comprising the file, assuming that input symbols and output symbols represent the same number of bits of data.

Luby continues, in the summary-of-the-invention section to describe the decoding process, in detail.

It should be noted that Luby's decoder and decoding system depend critically on information generated by, and incorporated into, output symbols by Luby's encoder. As stated by Luby, quoted above, error-correcting codes, such as Luby's, generally depend on information about the infidelities of the channel through which the data is being transmitted. In complete contrast to that approach, a universal discrete denoising system, as stated in Wiessman, "estimates the input sequence to minimize a given fidelity criterion. The algorithm is universal in the sense that it requires no knowledge of the input sequence or its statistical properties" (see Weissman, Abstract). The current application describes an apparatus that carries out a denoising method designed to denoise a received signal without knowledge of the originally transmitted signal, without redundant information included in the signal, and without knowledge of the channel-transmission characteristics. That is why the method employs statistical inference based on character occurrence within contexts. The claimed apparatus of claim 1 of the current application stores a received digital signal that has been corrupted by a channel and additionally stores a partially corrected sequence of symbols carried out by preliminary denoising of the received digital signal that produces a degradation function. A partially corrected sequence of symbols and the degradation function are produced by the claimed apparatus that receives the corrupted digital signal. Thus, the apparatus does not depend on any information about the channel or any additional information incorporated into the signal through an encoding process. The apparatus then substitutes corrected symbols for certain symbols of the received digital signal in order to reduce an overall estimate of signal degradation of the corrected digital signal using the degradation

function. The current application is not directed to an error-correcting code, or any kind of encoding/decoding system, as is Luby. Instead, claim 1 is directed to an apparatus that denoises a received digital signal without relying on any information encoded into the signal or known about the channel through which the signal was received. The current application represents a very different approach to signal denoising than the error-correcting-code-based method of Luby.

There is simply no justification for combining Luby and Wiessman, as suggested in the above quote from the Office Action by the Examiner. Wiessman and the current application are both directed to universal denoising techniques, while Luby is directed to traditional error-control-coding-based techniques. Significantly, Luby does not teach, mention, or suggest that for which the Examiner cites Luby, as discussed above.

According to M.P.E.P. §2143.01(III): "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the results would have been predicable to one or ordinary skill in the art." Even were Luby and Wiessman combinable, which they are not, since they are directed to quite different, and generally mutually exclusive approaches to signal denoising, the combination would not be obvious unless the combination produces predictable results. The Examiner has provided no analysis or rationale for such combination, or any statement as to the predictability of the combination. As discussed in M.P.E.P. §2143: "The key to supporting any rejection under 35 U.S.C. §103 is to clear articulation of the reason(s) where the claimed invention would have been obvious. The Supreme Court in *KSR* noted that the analysis supporting a rejection under 35 U.S.C. §103 should be made explicit." In Applicants' representative's respectfully offered opinion, a relatively concise misstatement of the teachings of Luby, based on a four-line passage, combined with a single sentence asserting that a combination Luby and Wiessman would make the currently-claimed apparatus obvious, does not constitute an analysis or clear articulation rationale for obviousness. In general, there would be no obvious reason to use a universal denoising method, such as that described by Wiessman, were one able to initially encode the signal prior to transmission. Error-correcting codes are well known,

and provide high-fidelity error detection and correction. By contrast, universal discrete denoising can only estimate corrections made to a received, noisy signal, as discussed in the current application and in Wiessman, by seeking to minimize an estimate of signal degradation produced by a degradation function. Thus, in the case that one has the luxury of encoding the signal prior to transmission, one would generally employ a high-fidelity error-correcting code, as disclosed in Luby, rather than relying on statistical inference, as in universal-discrete-denoising techniques. It is only in a case that error-control-encoding approaches, or other such approaches, are unavailable, due to inability to encode data prior to signal transmission, that universal discrete denoising provides significant, obvious benefit. In short, Luby and Wiessman are not combinable, and would not be obviously combined by one skilled in the art. In Applicants' representative's respectfully offered opinion, the rejection of claims 1, 2, 4, 7, 8, and 10 under 35 U.S.C. §103(a) as being unpatentable over Wiessman in view of Luby fails, both because the Examiner has mischaracterized that which Luby discloses and because Wiessman and Luby are not combinable. The Examiner appears to offer the rationale (G) described in M.P.E.P. § 2143, and has not provided alternative rationales, such as rationales (A)-(F) mentioned in M.P.E.P. § 2143. Therefore, Applicants' representative cannot find, in the Office Action, any rational basis for the assertion that the currently claimed invention is obvious in view of Wiessman and Luby.

The rejection of claims 13, 14, and 16 also fail for many of the same reasons as the rejections of claims 1, 2, 4, 7, 8, and 10 fail, as discussed above. Again, the Examiner states that:

> However, Luby discloses to generate a processed digital signal from said received digital signal by replacing symbols in said received digital signal (col. 15 lines 42-46), wherein said controller replaces each symbol having a value **I** in a context of that symbol in said received digital signal with a symbol having a value **J** if said replacement reduces an estimate of overall signal degradation in said processed digital signal relative to said input digital signal as determined using said degradation function and said partially corrected sequence of symbols (col. 13 lines 49-60).

As discussed above, Luby does not teach, mention, or suggest that which the Examiner ascribes to Luby. **I** and **J** in Luby are keys, not symbol values. Luby does not once

teach, mention, or suggest any kind of degradation function. There is no mention of the degradation function in either the passage on lines 42-46 of column 15 or in the passage of lines 49-60 of column 13. As discussed above, Luby is directed to an error-control-coding-based encoding/decoding system, which is an entirely different approach to the problem of signal denoising. In encoding/decoding schemes, a signal is encoded in a way that a decoder can replicate the encoded signal, even when portions of the encoded signal are garbled or lost during transmission through an error-prone communications channel. Universal discrete denoising, by contrast, processes a noisy signal without reliance on any information with regard to channel characteristics and without any information regarding the initial, clean signal prior to transmission. Furthermore, in Luby's scheme, as discussed beginning on line 13 of column 9 of Luby, each output symbol output by the encoding process is identified by a key. The key of each output symbol is preferably distinct from the keys of all other output symbols, to allow the receiver of the output signals to distinguish one output symbol from all other output symbols. Clearly, Luby is not concerned with the context of a symbol during the decoding process, but instead relies on a key associated with an output symbol that uniquely identifies the output symbol. A current application discusses denoising by means of an overall optimization process, in which an estimate of overall signal degradation is minimized by symbol substitutions. Luby is a deterministic method, and is not based on statistical inference or optimization. Luby simply does not teach, mention, or suggest anything related to what the Examiner asserts Luby to disclose. Because the rejections of claims 13, 14, and 16 rely on a combination of Fitton and Luby, and because Luby does not teach, mention, or disclose anything related to the current application and currently claimed invention, the rejections fail.

Fitton is directed to quite a different type of system and method than that to which the current application is directed. Fitton describes a channel estimator, essentially a system that estimates the response of a particular communications channel, to allow subsequent packets received through the channel to be processed using the estimated channel response function to compensate for fading and interference. As discussed in paragraph [0011] of Fitton, Fitton's invention addresses:

> The present invention addresses, among other things, the problem of determining a transmission channel impulse response estimate from a packet data signal, such as a High Rate Bluetooth signal, in which none of the packet data is specifically allocated to providing a dedicated training signal. The invention also addresses the problem of providing improved channel estimations where only a short training sequence or no training sequence is provided. Aspects of the invention further address the problem of tracking variations in the channel response.

Thus, Fitton is primarily concerned with identifying a training sequence or other such information within a packet in order to be able to estimate the response of a channel using an adaptive filter configured to use the training sequence. Fitton teaches nothing at all concerning using the context of symbols within a noisy signal or carrying out symbol replacement in order to reduce the estimate of overall signal degradation. Instead, Fitton briefly describes applying a channel-response estimate to subsequent packets in order to compensate for fading and interference. However, the disclosed technique clearly does not involve symbol replacement within a noisy signal in order to minimize an estimated overall signal degradation via a degradation function. Fitton teaches no details regarding the compensation for fading and interference, briefly mentioning that aspect of using channel responses at the end of [0009]. Instead, Fitton is almost exclusively concerned with identifying a training sequence within a received packet that can be used by an adaptive filter to estimate the channel response.

Applicants' representative's previous comments concerning the inability to combine Luby with Wiessman apply, as well, to an attempt to combine Luby with Fitton. Luby employs error-correcting-code-based encoding/decoding techniques in order to guarantee reliable information transfer through an error-prone channel. By contrast, Fitton estimates a channel response, based on training sequences extracted from packets, in order to apply the estimated channel response to subsequently received data to compensate for fading and appearance. The estimate channel response is a set of numbers, or coefficients, that characterize an adaptive-filter function that is applied to a received signal. These are two entirely different approaches. Error-correcting-code-based encoding/decoding techniques are deterministic, and can be designed to detect and correct certain types and quantities of errors with 100 percent accuracy. These

techniques depend on encoding information into the signal that can be used, during decoding, to compensate for errors introduced into the signal. By contrast, Fitton attempts to estimate a channel response based on information received through the channel, and then to employ that channel response to compensate for fading and interference in subsequently received data packets. Again, it appears that the Examiner is providing a rationale of type (G) for this obviousness-type rejection, according to M.P.E.P. §2143. Because the combination of Fitton and Luby would produce no obvious advantage, and because Luby does not teach, mention, or suggest that which the Examiner asserts Luby to disclose, the rejection necessarily fails.

In summary, Luby does not teach, mention, or suggest that for which the Examiner cites Luby. Luby is not combinable with either Weissman or Fitton, since Luby's approach depends in initially encoding a signal, prior to transmission, while Weissman attempts to denoise a received signal using only the received signal, and Fitton attempts to characterize the transmission channel using only received data packets. When encoding based on eraser codes is available, encoding generally provides for more accurate error detection and correction. Were error-control coding used, and were it insufficient, then it is possible that Weissman's approach or Fitton's approach might provide benefit, but, in that case, there is no obvious benefit to having used error-control coding in the first place. The Examiner has failed to provide an analysis or rationale for the combination, failed to show a predictable result form the combinations suggested, and failed to show any teaching, mention, or suggestion for many of the limitations of the current claims, including minimizing an overall estimated signal degradation using a degradation function, which is included in all three independent claims 1, 7, and 13.

In Applicants' representative's opinion, all of the claims remaining in the current application are clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

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Enclosures:
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